

What is claimed is:

1. A method of thermoacoustic imaging of structures of tissue, comprising  
immersing said tissue in an acoustic coupling media for acoustically  
coupling said tissue to an acoustic sensor array,

5 delivering to said tissue a fluorescent dye responsive to electromagnetic  
radiation,

irradiating said tissue with a source of electromagnetic radiation at a first  
frequency to stimulate fluorescence of said dye and a thermoacoustic response thereto,

detecting said thermoacoustic response and producing therefrom a dye-  
10 enhanced image of structures of said tissue.

2. The method of claim 1 further comprising irradiating said tissue with a  
source of electromagnetic radiation at a second frequency stimulating substantially less  
fluorescence than said first frequency, and detecting a thermoacoustic response to said  
second frequency stimulation and producing therefrom an unenhanced image of  
15 structures of said tissue.

3. The method of claim 2 further comprising combining said dye-enhanced  
and unenhanced images of structures of said tissue.

4. The method of claim 3 wherein combining said images comprises forming  
a difference between said images.

20 5. The method of claim 1 further comprising stimulating said tissue with  
acoustic excitation and detecting an acoustic echo thereof, and producing therefrom an  
ultrasonic image of structures of said tissue.

6. The method of claim 5 further comprising combining said dye-enhanced  
and ultrasonic images of structures of said tissue.

25 7. The method of claim 6 wherein combining said images comprises forming  
a difference between said images.

8. A thermoacoustic imaging system for imaging structures of tissue,  
comprising

a source of light for illuminating said tissue to stimulate a thermoacoustic  
30 response, with a frequency of light that is subject to scattering and attenuation within 10

mm of penetration into said tissue,

an acoustic coupling media for acoustically coupling said tissue to an acoustic sensor array, and

an acoustic sensor array for detecting said thermoacoustic response and  
5 producing therefrom an image of tissue structure with 10 mm of the surface of said tissue.

9. A thermoacoustic imaging system for imaging structures of tissue,  
comprising

a source of electromagnetic radiation for irradiating said tissue to stimulate  
a thermoacoustic response,

10 an acoustic coupling media for acoustically coupling said tissue to an  
acoustic sensor array,

an acoustic sensor array for detecting said thermoacoustic response,  
comprising a linearly arranged array of transducers, and

circuitry for reconstructing an image of said tissue from thermoacoustic  
15 response detected by said linearly arranged array of transducers.